



Proposed Fleet Characteristics in MOBILE6

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Presentation Overview

- Describe proposed methodologies for developing
 - ◆ Mileage Accumulation Rates
 - ◆ Registration Distribution Curves
 - ◆ Vehicle Counts
- Present examples comparing proposed MOBILE6 results to current MOBILE5b data

Documentation

- Mileage Accumulation Rates
 - ◆ ***“Update of Fleet Characterization Data for Use in MOBILE6: Final Report,”*** M6.FLT.001) Arcadis Geraghty & Miller, Mountain View, CA, 1998. (L. Browning, et al.)
- Registration Distribution and Vehicle Counts
 - ◆ ***“Fleet Characterization Data for MOBILE6: Development and Use of Age Distributions, Average Annual Mileage Accumulation Rates, and Projected Vehicle Counts for Use In MOBILE6,”*** M6.FLT.007 (T. Jackson)

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Changes from MOBILE5

- More vehicle categories
 - ◆ from 8 categories to 28 categories
 - ◆ Allows maximum flexibility to reflect vehicle class-specific emission standards
- Updated sources of registration distribution, mileage accumulation rate and vehicle count data
 - ◆ Registration Distribution -- 1996 Polk
 - ◆ Mileage Accumulation Rate -- 1995 NPTS, 1992 TIUS
 - ◆ Vehicle Counts -- 1996 Polk, 1998 CFEIS, 1999 AEO99, 1996 Ward's

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MOBILE5 Category Number	MOBILE5 category description	MOBILE6 category description	MOBILE6 Category Number
1	Light-duty gasoline vehicle	Light-duty gasoline vehicle	1
2	Light-duty gasoline truck 1	Light-duty gasoline truck 1	2
		Light-duty gasoline truck 2	3
3	Light-duty gasoline truck 2	Light-duty gasoline truck 3	4
		Light-duty gasoline truck 4	5
4	Heavy-duty gasoline vehicle	Heavy-duty gasoline vehicle class 2B	6
		Heavy-duty gasoline vehicle class 3	7
		Heavy-duty gasoline vehicle class 4	8
		Heavy-duty gasoline vehicle class 5	9
		Heavy-duty gasoline vehicle class 6	10
		Heavy-duty gasoline vehicle class 7	11
		Heavy-duty gasoline vehicle class 8A	12
		Heavy-duty gasoline vehicle class 8B	13
		Heavy-duty gasoline bus	14
5	Light-duty diesel vehicle	Light-duty diesel vehicle	15
6	Light-duty diesel truck	Light-duty diesel truck 1	16
		Light-duty diesel truck 2	17
7	Heavy-duty diesel vehicle	Heavy-duty diesel vehicle class 2B	18
		Heavy-duty diesel vehicle class 3	19
		Heavy-duty diesel vehicle class 4	20
		Heavy-duty diesel vehicle class 5	21
		Heavy-duty diesel vehicle class 6	22
		Heavy-duty diesel vehicle class 7	23
		Heavy-duty diesel vehicle class 8A	24
		Heavy-duty diesel vehicle class 8B	25
		Heavy-duty diesel bus school	26
		Heavy-duty diesel bus other	27
8	Motorcycle	Motorcycle	28



Mileage Accumulation Rates

- Annual rate of mileage accrual per vehicle by vehicle class and age (1-25+)
- Base Data Source:
 - ◆ 1998 Update of Fleet Characterization Data for Use in MOBILE6: Final Report by Arcadis Geraghty & Miller.
 - ◆ Provides mileage accumulation rates for 18 vehicle categories

Mileage Accumulation Rates (continued)

- Light-duty vehicles
 - ◆ Data Source: 1995 Nationwide Personal Transportation Survey (NPTS)
 - ◆ Provides two mileage estimates
 - self-estimated by interviewee
 - annualized mileage calculated from two separate odometer readings taken 2-6 months apart

Mileage Accumulation Rates (continued)

- ❖ Used annualized mileage for analysis
- ❖ All survey data was population weighted to reflect the national fleet
- ❖ Population-weighted annualized mileage rates were then averaged and best fit curve analyses performed

Mileage Accumulation Rates (continued)

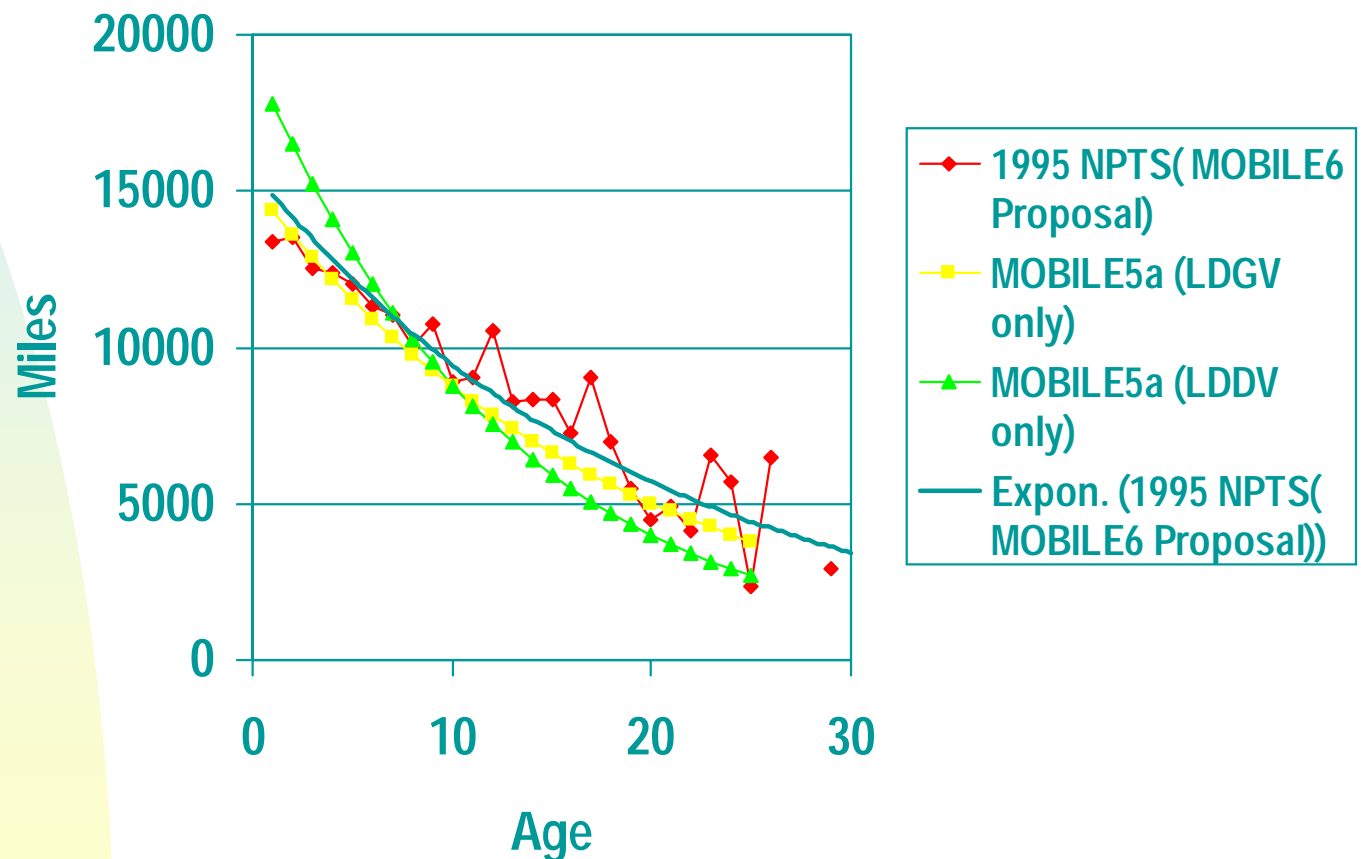
- ◆ Light-duty Trucks and Heavy-duty Trucks
 - ◆ Data Source: 1992 Truck Inventory and Use Survey (TIUS)
 - ◆ Data evaluated to remove unusable data
 - fuels other than gasoline or diesel
 - records with no model year designation
 - cases where reported weight classes and vehicle weights were inconsistent
 - ◆ Annual mileage accumulation rates were averaged for each weight class and model year

Mileage Accumulation Rates (continued)

◆ Buses

- ◆ Data Sources: 1994 Federal Transit Administration and 1997 School Bus Fleet Fact Book

Light-duty Vehicle Annual Mileage Accumulation Rate



Registration Distribution

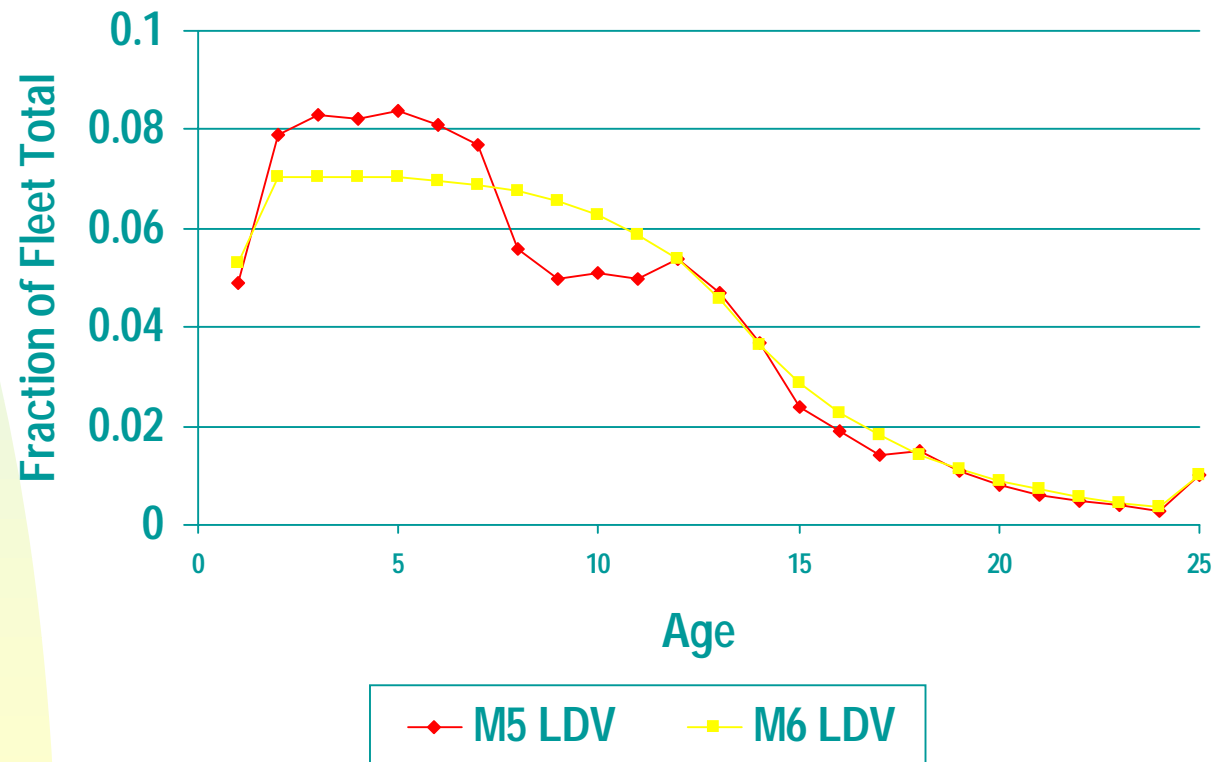
- Distribution of vehicles in each vehicle class by age (1-25+)
- Base Data Source:
 - ◆ 1998 *Update of Fleet Characterization Data for Use in MOBILE6: Final Report* by Arcadis Geraghty & Miller.
 - ✦ Based on calculations of July 1, 1996 “snapshot” fleet
 - ✦ Provides vehicles in use for 18 vehicle categories
 - grouped by emission standard categories



Registration Distribution (continued)

- Best fit curve analysis applied to 18 categories and several aggregate categories
- Final curves for 7 aggregate categories
 - ◆ These 7 distributions will be used for multiple subcategories
 - ◆ registration distributions for motorcycles are from MOBILE5b

Registration Distribution: Comparison of MOBILE5 "Light-duty Vehicle Class" to MOBILE6 "Light-duty Vehicle Class"



Vehicle Counts

- Used only for estimating VMT distribution by vehicle class by calendar year
- Calculated vehicle counts for calendar years 1996-2050
 - ◆ Using MOBILE5 data for 1982-1990
 - ◆ Linear interpolation between 1990 and 1996 “real” data points

Vehicle Counts (continued)

- Light-duty vehicle methodology
 - ◆ Began with total light-duty vehicle base fleet
 - ◆ fleet as of July 1, 1996 (from Arcadis report)
 - ◆ includes light duty passenger cars and light duty trucks

Vehicle Counts (continued)

- ◆ Add sales estimate to previous year's vehicle population
 - ◆ Projected sales for 1998 from EPA's CFEIS database used as base sales rate
 - ◆ Used 1999 Department of Energy Annual Energy Outlook(AEO99) to estimate light-duty sales growth rate
 - AEO99 reports 0.5% annual growth rate for 1997-2020
 - ◆ Applied 0.5% growth rate to 1998 CFEIS sales to estimate sales for 1997 through 2020
 - sales held constant at 2020 rate for 2021-2050

Vehicle Counts (continued)

- ◆ Apply scrappage rate to vehicle population and subtract from vehicle population to get final vehicle count
 - ◆ Scrappage rate from 1996 Ward's World Vehicle Forecasts and Strategies
 - provides estimated scrappage rates in five year increments
 - assumed “passenger car” scrappage to represent all light-duty vehicles

Vehicle Counts (continued)

- Equation

- $VC_x = VC_{x-1} + Sales_x - (Scrappage_x)$

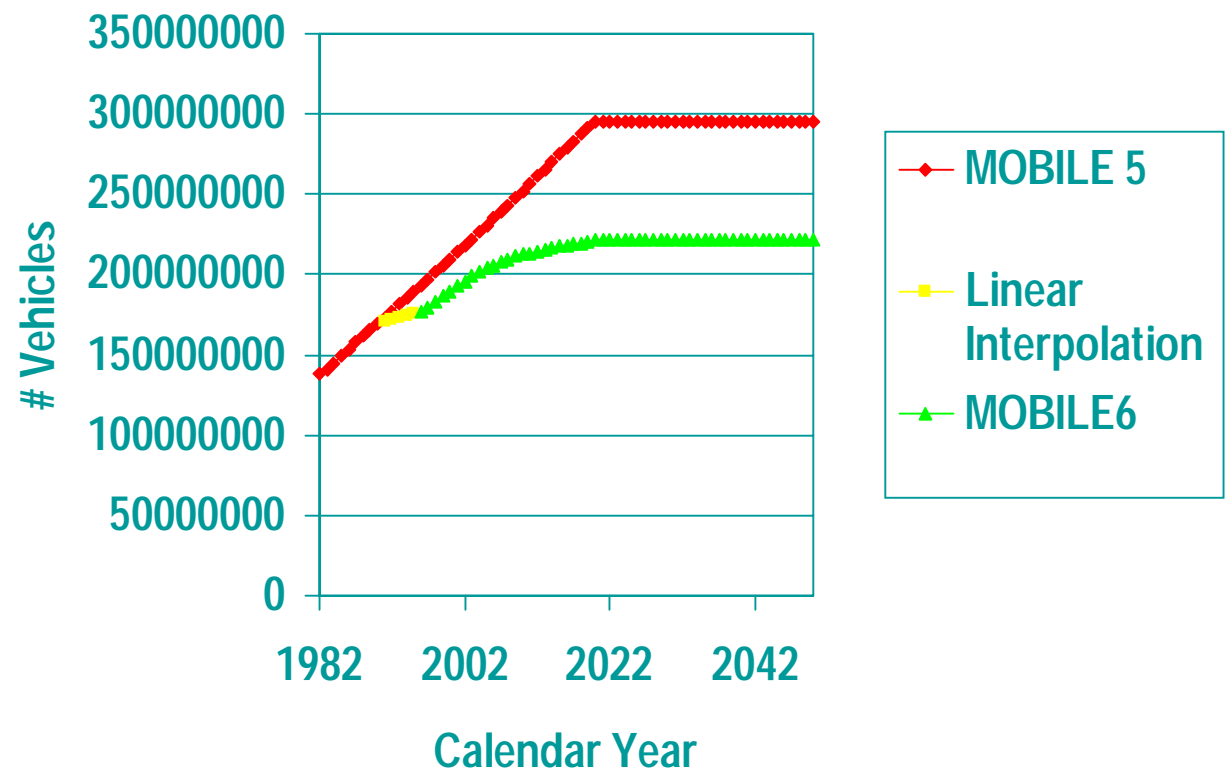
where: VC= total vehicle count for category

Sales= # new vehicles sold

Scrappage= # vehicles removed from fleet

x=calendar year

Comparison of Light-duty Vehicle (LDV) Vehicle Counts, 1982-2050



Vehicle Counts (continued)

- Splitting into Light-duty vehicles and trucks
 - ◆ Applied car/truck proportioning method outlined in “VMT and Emissions Implications of Growth In Light Truck Sales”
 - ◆ Car/Truck ratio changes over time
 - ✦ provides car/truck fleet splits derived from sales rate changes that lead to a 40:60 car to truck relationship in 2008 and beyond

Vehicle Counts (continued)

- Splitting Light-duty trucks into four categories
 - ◆ based on Clean Air Act regulatory classes
 - ◆ Used ratios from 1998 CFEIS database to split truck classes

Vehicle Counts in MOBILE6

Data Sources

1996 Polk

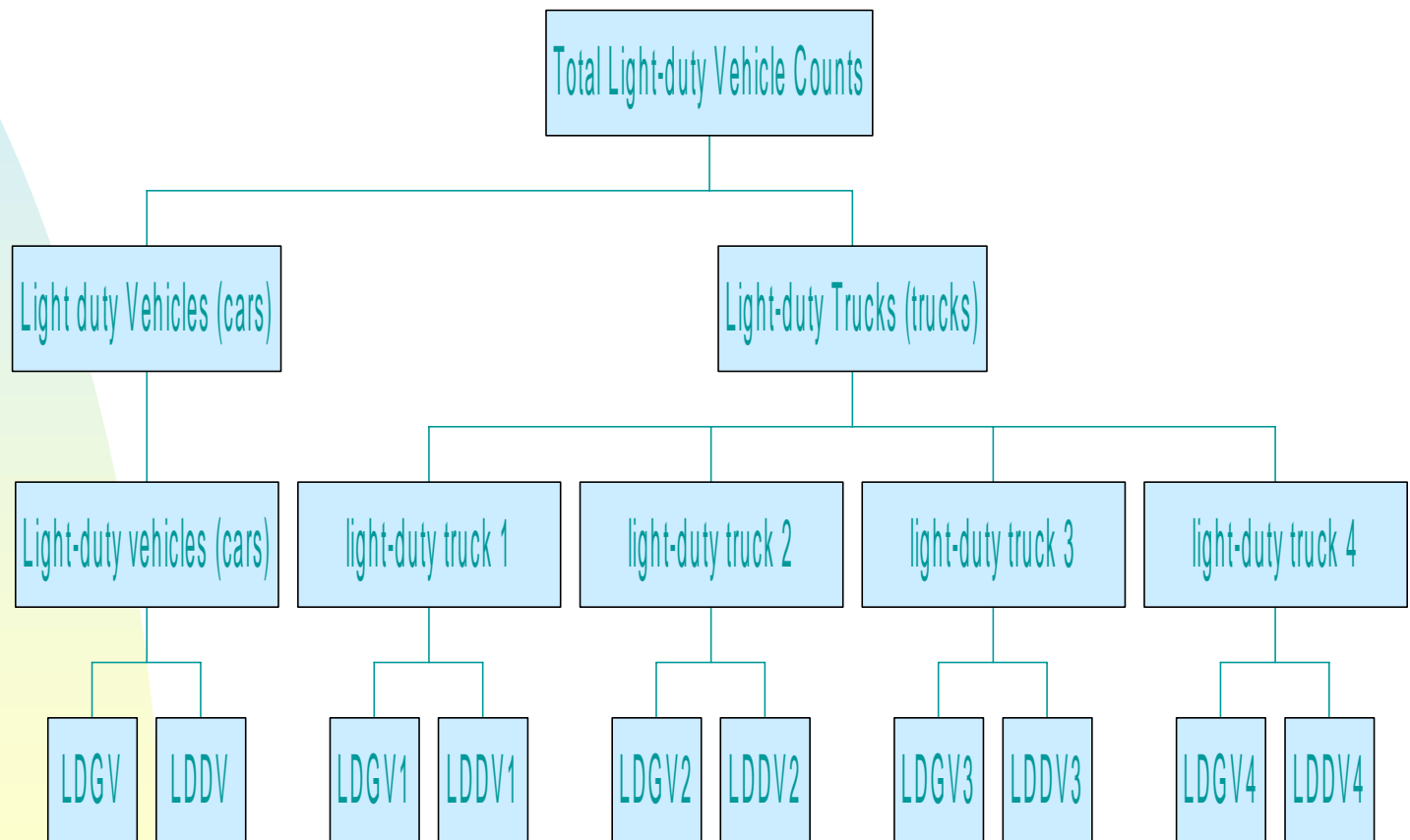
1998 CFEIS/1999 AEO99

1996 Ward's

1998 EPA Staff
Calculation

1996 Polk
1998 CFEIS

1996 Polk
MOBILE6 Dieselization
Algorithm



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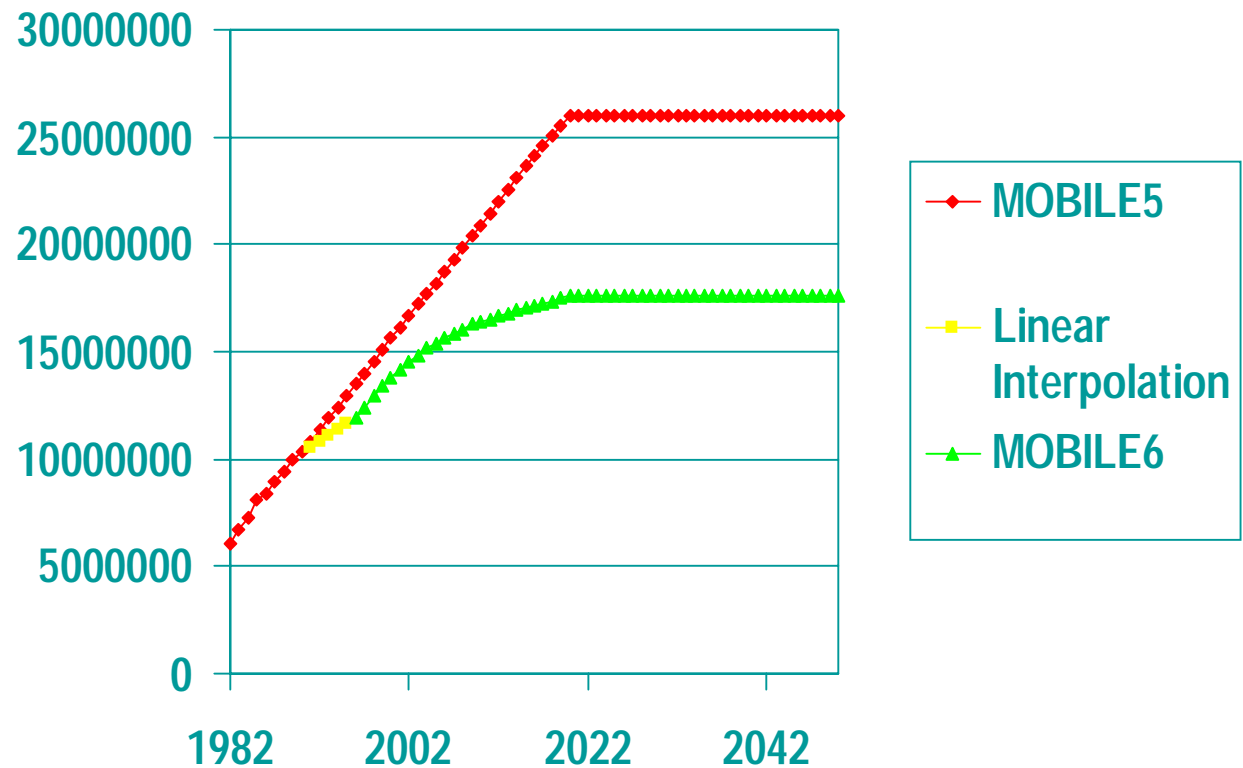
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Vehicle Counts (continued)

- Heavy-duty vehicle counts
 - ◆ Same calculation as light-duty, except:
 - ✦ Sales AND scrappage rates from 1996 Ward's World Vehicle Forecasts and Strategies
 - assumed "commercial" category to represent heavy-duty vehicles
 - ✦ Growth rate from 1997 Regulatory Impact Analysis for heavy-duty engines
 - ◆ Split into vehicle categories based on ratios from 1996 Arcadis report

Comparison of Heavy-duty Vehicle (HDV) Vehicle Counts, 1982-2050





Summary

- Smoothed data to apply to multiple categories and calendar years
- Updated sources of data
- Expanded vehicle categories

Document References

- Energy Information Administration. ***Annual Energy Outlook 1999***. U. S. Department of Energy, Washington, D.C., 1999.
- German, John. ***VMT and Emission Implications of Growth in Light Truck Sales***. Proceeding of the 1997 Air & Waste Management Association conference, "Emission Inventory: Planning for the Future." Air & Waste Management Association, Pittsburgh, PA, 1998.
- Pemberton, Max. ***1996 World Vehicle Forecasts and Strategies: The Next 20 years: A Special Report Covering the Period from 1960 - 2015***. Ward's Communications. Pemberton Associates, Warwickshire, UK, 1996.
- Office of Air and Radiation, Office of Mobile Sources. 1998 sales data as reported by automotive manufacturers to the Vehicle Programs and Certification Division (VPCD) **Certification and Fuel Economy Information System (CFEIS)** database. U.S. Environmental Protection Agency, Ann Arbor, MI, 1998.